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THE
PSYCHOLOGICAL BULLETIN

EIDETIC PHENOMENA *

BY HEINRICH KLÜVER
Behavior Research Fund, Chicago

An analysis of recent studies on eidetic phenomena shows clearly that during the last years the majority of investigators have been more interested in eidetic images (EI) as indicators of personality trends than in eidetic imagery itself. As a matter of fact, too great an emphasis has been placed on the relation of EI to personality; there is no doubt that an all-around study of eidetic imagery itself must be considered basic for investigations in the field of personality. Furthermore, we cannot be satisfied with the result that the examination of EI reveals certain *consistencies;* we must demand proof that the consistencies found so far are different from those of other subjective visual phenomena. Unless such a difference is demonstrated there is no hope of ever clarifying the relation of EI to personality and personality development. In general, it is to be regretted that in the experimental work recently published more attention has been paid to the Marburg hypotheses on "types," "memory-levels," etc., than to the problems involved in the methods for determining eidetic imagery.

In the following we shall concern ourselves chiefly with the experimental studies of the last four years; our last review published in this journal (59) covered the literature up to about the year 1927.† We shall first consider the work reported in the follow-

* Studies from the Behavior Research Fund of the Institute for Juvenile Research, Chicago. Series B, No. 185.

† Since this review was ready for publication in December, 1930, it has unfortunately not been possible to take into consideration a number of recent publications; however, a list of the more important titles has been added to the Bibliography (*cf.* numbers 105–127).

ing three books: the Ergänzungsband 16 of the Zsch. f. Psychol. by E. R. Jaensch and others (40), the "Grundformen menschlichen Seins" by E. R. Jaensch and collaborators (39), and the Beiheft 43 of the Zsch. f. ang. Psychol. by Bonte, Liefmann and Roessler (5a). If we evaluate the experiments described in the first two books in terms of the hypotheses formerly set forth by the Marburg school it becomes apparent that the study of eidetic imagery is approached here from a new angle. In most of these experiments the subjects were adults. The main object was not an examination for EI but an all-around investigation of different perceptual and imaginal responses. The results gained on adults, then, were analyzed in the light of the facts previously arrived at in eidetic research on children. Jaensch holds that a certain "coherence" between "Vorstellungen" and "Umwelt," between thinking and object, is characteristic of the period of early childhood. In the course of ontogenetic development this close coherence which is indicative of an "integration" of psychic and somatic functions disappears in most cases. EI are merely *one* of the symptoms of the "integrated type" and, therefore, cannot be understood without reference to typological studies. It is maintained that the *form* of the perceptual and imaginal responses in adults "may be considered as the solidified, petrified product of functions which in the eidetic phase build up the perceptual world" (30). In various experimental contributions (40) the attempt is made to show that the "coherence" with the environmental world existent in children, has left—to use Jaensch's somewhat involved terminology—"coherence-petrifactions in the permanent structure of perceptions" in adults.

H. Ruschmann (85) reports that not only EI, AI (after-images), and MI (memory-images) but also the perceptions of eidetic persons are influenced by "disturbing stimuli." She employed the horoptoscope (Jaensch's investigation of the Kovariantenphänomen, cf. 58, p. 165), the "angle- and step-phenomenon" described by Hoffmann, asymmetrical objects, and pictures in presenting visual stimuli. In some of the experiments the influence of disturbing (acoustic, optical, etc.) stimuli was quantitatively studied. It is concluded that sensory disturbances, introduced while perceiving, call into play central factors and reduce the effect of the objective stimuli. What is actually perceived, is in such case only partly determined by peripheral stimulation. It is pertinent to cite here Kiesow (57), who suggests that deviations from Emmert's law when resulting from the

application of disturbing stimuli have probably nothing to do with the activation of processes or phenomena on "higher" levels but with reflex movements of the eyes. That such reflex movements may also play a rôle in changing the perception of an object under the influence of disturbing stimuli is a point not considered by Ruschmann.

E. Mayer (**73**), in studying Jaensch's Kovariantenphänomen, deviations from the horopter and depth-perception in stereoscopic experiments with non-eidetic adults, found that upon a decrease in illumination the measurements taken were similar to those previously obtained from eidetic children under normal illumination. The instability of perceptions supposedly a characteristic of the "eidetic phase" in childhood was also demonstrated in non-eidetic adults under the conditions of twilight-vision. In twilight for instance, the appearance of a given visual object was influenced by the shape or movement of other objects in the field of vision. In stereoscopic investigations with children the fact was brought out that the "before" and "behind" was not determined to such an extent by crossed disparation as in adults. It is concluded that a reliance on crossed disparation is a product of ontogenetic development.

Kranz (**66**), concerned with perceptual differences in personality types, used mostly "highly integrated" persons as subjects. The point of departure in his study was the distinction, recently propounded by the Marburg school, between the "integrated" and the "non-integrated" type. While in the integrated type there is "an interpenetration of functions," the psychic functions of the non-integrated type are characterized by relatively great independence and stability. Various forms of integration are distinguished. Kranz used very strong cases of the so-called I_1- and I_2-type. He examined the reactions of his subjects to various visual stimuli and found among other things that the values for "co-variations" (in a study of Jaensch's Kovariantenphänomen) tended towards zero in non-integrated persons. Similar results were obtained in determining the deviations from the horopter (Hering-Hillebrandsche Horopterabweichung), and in studying depth-perception. In the integrated types the same depth impression could be elicited by different degrees of crossed disparation; in non-integrated persons the effect of depth was almost entirely dependent on crossed disparation. Whenever there was a rivalry of different depth criteria, the presence of "meaningful wholes" was, in the case of integrated persons, a factor of greater importance than crossed disparation. The study of the "abso-

lute " or " relative " localization of objects also showed the important rôle of central factors in integrated persons. In this group the so-called absolute depth localization was determined to a greater extent by the interests and the imaginal activity than by binocular parallax. The micropsia and macropsia experimentally induced by Rollett's plates (98) was far more pronounced for integrated than for non-integrated individuals. The difference between the position of an apparent vertical (or horizontal) line and the objective vertical (or horizontal) line (line presented on a pattern with oblique black-white stripes) was far greater in integrated than in non-integrated cases. Experiments with Helmholtz' telestereoscope and an investigation of the relation between visual and tactual space in which prismatic spectacles were employed also brought to light the dependence of perceptual phenomena on the personality type of the subject. Finally, the lability of the integrated type was demonstrated in repeating some of the experiments by Hoff and Schilder (24) on postural persistence.

The factors influencing depth-perceptions in adults are the subject of special study by Simon (95). It is shown that even in adults crossed disparation cannot always compete with central factors in determining the depth impression.

Kobusch (65) presents an analysis of the behavior of MI in adults and reaches the conclusion that " between the pure EI and the pure MI there is a continuum of steps " the height of which is exactly determined by the subject's attentional level; that is to say, the greater the attentional effort of the subject directed to the MI, the greater the similarity between MI and EI with respect to phenomenal appearance and behavior of the image. The MI were projected on various grounds and studied with techniques formerly employed in eidetic investigations. Even the exact size of the MI was determined under different conditions, *e.g.*, under the influence of Anhalonium Lewinii (mescal). Certain differences in the behavior of MI in near distances (up to about 140 cm.) and far distances are also explained by " attention." In a series of experiments performed by Bamberger (2) the conditions are defined under which eidetic children take an EI for a real object. The remainder of Ergänzungsband 16 (40) consists of theoretical discussions by E. R. Jaensch in which stress is laid upon the value of research on perceptual and eidetic phenomena for philosophy (31–35). In this connection Jaensch's book on " reality and value " in philosophy and

culture (29) in which frequently reference is made to the Marburg psychological studies must be mentioned.

Although some of the experiments in Ergänzungsband 16 are not well controlled some of the findings are of considerable importance. There seems to be no doubt that under certain experimental conditions the perceptions of adults are similar to those of children, and that any increase in our knowledge of such conditions is to be welcomed. Whether certain similarities between the perceptual responses of children and adults really demand a genetic interpretation is a question requiring further research. Another point is to be considered in evaluating Ergänzungsband 16. Even though one may not subscribe to Jaensch's distinction of an integrated and a non-integrated type the experiments so far performed seem to demonstrate conclusively the great variations in the perceptual responses of adults to identical stimulus situations. Undoubtedly, many of the "classical" experiments in the fields of physiological optics and sensory psychology have been performed only on certain "types"; that is to say, individuals with very unstable perceptual responses were often ruled out as undesirable because of the variability of their responses and the impossibility of interpreting their reactions in terms of certain "laws."

In the "Grundformen" (39) the experimental foundation of the new Marburg typology is presented. Jaensch (38) points out that in psychology we are in need of a classification or typology based on "natural systems" (Cuvier). Only such natural systems permit of an ever finer differentiation. Such natural systems are found in the "integrated" and the "non-integrated" type. They are believed to be not products of an arbitrary classification but are considered "basic forms." These types are not entirely unrelated to the types formerly proposed by Jaensch—the B- and the T-type. At present the term B-type is applied only to integrated persons with symptoms pointing to a basedoid constitution. A similar relation holds between the T-type and the non-integrated type (98). Various forms of integration are described. There is an integration "nach aussen" (I_1-type) and an integration "nach innen." In the first case there is intimate contact and "coherence" with the external world, in the second case this coherence is lacking. There exists a cleavage between thinking and perceiving, between *Vorstellungswelt* and *Wahrnehmungswelt*. But aside from this cleavage the "psychic functions display the characteristics of integration" (45). Between

these two types there is the I_2-type which is only temporarily, in the presence of certain stimuli, integrated. In addition, a synesthetic integrated type, an I_s- or S-type is described. Representatives of these various types, in most cases adults, are studied by different methods.

In the investigation of Jaensch and Neuhaus (46) the extreme cases of the I_1- and S-type were examined with respect to affectivity, AI, EI in different sense fields, hallucinations, pseudohallucinations, synesthesia, and various perceptual phenomena. Whenever possible experimental methods were employed. But since the "total personality," and not a single function, was of interest in the "Grundformen" other methods were also used. The investigation of Jaensch and Lucke (42) deals with the I_1-type and the I_2-type. Widely different phases of behavior such as reactions to Müller-Lyer's illusion, memory, dreams, and various bodily functions were analyzed. By way of summary it is pointed out that the I_1- and the I_2-type differ in twenty-six respects. The above mentioned integrated type with "inner" coherence, most frequently found among certain sportsmen, is studied by Jaensch and Möckelmann (45). No research is reported on the pure non-integrated type. Jaensch has not much hope of finding this type in Germany, at least not in German universities, but he is of the opinion that persons of this type abound in America. So far only individuals on the borderline between the integrated and the non-integrated type have been examined (49). The study by Wiedling and Jaensch represents at the same time an interesting experimental contribution to our knowledge of volitional functions. In an analysis of twenty synesthetic cases (44) the importance of "symbolic" thinking in integrated cases is stressed. In an examination of the pupillary reflex in strong eidetic children it was found that the EI of bright objects led to a contraction, and the EI of dark objects to a dilatation of the pupils. Jaensch and C. Köhler speak of an "eidetic pupillary reflex" (41).

The value of the "Grundformen," it seems to us, lies (1) in the fact that experimental methods have been utilized in a very ingenious way in the study of personality; (2) in a number of experimental findings which are of distinct value without reference to any typology; (3) in the formulation of a number of hypotheses which can be tested by experiment. It is, of course, to be regretted that the Marburg school, again and again, changes the terminology in

typological matters. Instead of the B-, T-, BT-, TB-, T_B-, B_H-type and other subtypes previously proposed we have now the integrated and the non-integrated type with various subtypes. Whether or not these types are really "basic" types seems to us an unsettled matter. Furthermore, the concept of "types" itself may be viewed as of questionable value. Still it does not seem more questionable to us than "abilities," "factors," etc., in the field of mental measurement. In fact, it is hard to believe that "abilities" and "factors" express more adequately differences in the psychophysical functioning of the organism than Jaensch's "types" or that the theory of factors should be of greater significance for biological psychology than the Marburg theory of types.

In connection with the volume just discussed attention should be called to the articles by Warnecke (**98**) and Schmülling (**90**). Warnecke made an analysis of certain perceptual reactions in eidetic and non-eidetic I-types. Some interesting experiments on the influence of *Einstellung* on the perception of such cases are reported. Schmülling (**90**) studied AI, EI and perceptual phenomena when observed under intermittent retinal stimulation. He considers the method of intermittent stimulation as an effective means for detecting "latent" eidetic phenomena.

We shall now turn to Beih. 43 of the Zsch. f. ang. Psychol. It is out of the question here to review in detail the results reported in this book. The findings of Bonte, Liefmann and Roessler have a bearing on almost all phases of eidetic research. In general, the Marburg procedure for determining EI was followed. Bonte (**5**) found 67 eidetic cases in a group of 209 boys, aged nine to fourteen years, and 29 cases in a group of 85 backward children. Most frequently eidetic phenomena occurred "before the beginning" of puberty. In the whole group of 294 children there were only 21 very strong cases of Jaensch's degrees IV and V. These 21 children were given a large number of tests, including intelligence tests. The author concludes that individuals of the B- and the T-type are found on all intelligence levels; that there is a high correlation between "suggestibility" and the eidetic disposition of the B-type; that EI on the whole do not interfere with abstract thinking; and that eidetic individuals are at an advantage in tasks dealing with sensory material of certain kinds. It is asserted that only intelligent individuals use their EI consciously.

The studies of Liefmann (**71**) and Roessler (**84**) supplement

each other to some extent. Liefmann examined individuals aged ten to nineteen years; Roessler, children between the ages of six and ten. Liefmann's subjects were girls attending different high schools in Freiburg. Out of 834 girls tested for EI in group examinations, 177 were tested individually. Liefmann states that the "acme" of the eidetic disposition, *i.e.*, the age at which EI are found most frequently in the highest "degree," is the age of twelve. Eidetic phenomena were only infrequently reported between the ages of fifteen and seventeen years; but in the years following this period there was an increase in frequency. Most subjects had fluctuating EI. The different "types" of EI were not in any way related to the constitution types of W. Jaensch. Liefmann, furthermore, could not confirm the results of W. Jaensch on the effects on EI of Anhalonium Lewinii and other drugs. Tetany experimentally induced did not change or bring about eidetic phenomena. An examination of the skin capillaries at the nail bed of 68 eidetic and non-eidetic children (method of capillaroscopy) did not reveal any correlation between the capillary picture and the eidetic disposition.

Roessler (**84**) examined 421 out of 726 boys and girls individually. His study is of considerable significance in view of the Marburg hypothesis of a "unitary type." Forty per cent of the group of 726 children possessed EI. The highest percentages and the strongest cases were found in the six-year-old group. Roessler believes that this fact supports Jaensch's view that the primordial form of our perceptual and imaginal responses must be sought in EI. Although there is no doubt that Roessler, on the whole, has been rather successful in modifying and adopting the methods of Jaensch for young children, his work can be viewed merely as a starting point for future research on young children.

In the following, a number of publications, mostly articles, dealing with different aspects of eidetic research will be shortly considered.

EI and Personality Types. E. R. Jaensch (**26**) in replying to some critical remarks by G. Heymans points out that the typological method is not antagonistic to the statistical method in personality studies. Weil (**100, 101**), using adults as subjects, tries to show that the tendency to integration and disintegration in the make-up of a person is even apparent in his AI. His results on spatial displacements in AI and the tendencies to movement in AI deserve special attention. We should note in addition various perceptual

problems investigated from the typological angle. Experiments with Heckmann's color test and experiments on apparent size and apparent movement were performed. The conclusion is drawn that the greater the integration, the easier it is to modify the perceptually given content imaginally. J. Gross (**18**) is concerned with the " degree of integration " in six to eleven-year-old children. AI, EI and perceptions were studied in 240 cases. As of special interest we consider some of the findings on AI in children. Gross states for instance that the AI-methods for detecting an eidetic disposition cannot be used below the age of nine years, and that intermittence (**90**) doubles the duration of AI in nine-year-old children. O. Müller (**79**) exposed figures, permitting of various interpretations, tachistoscopically. The integrated cases manifested the tendency to see meaningful, interrelated wholes. The reactions of non-integrated individuals were far more objective and analytical. The answers of children often showed a high degree of originality; on the whole the behavior of children was similar to that of the integrated adults. Persons at the age of puberty assumed a highly critical attitude. In a series of experiments in which " incomplete " and ambiguous objects were exposed without any time limit the typological results of the tachistoscopic tests could be confirmed. The Rorschach test did not bring out very clearly the differences between the " synthetic " attitude of the integrated and the " analytical " attitude of the non-integrated type. Oeser (**80**) made the attempt to throw light on the psychology of the integrated and the non-integrated type by tachistoscopic reading experiments. Some of the conflicting results on tachistoscopic reading reported in the literature seem to be due to typological differences. Weber's study (**99**) purports to be a contribution to the psychology of thinking. The " affective-symbolic " thinking of the I_s-type and the " affective-realistic " thinking of the I_1-type are contrasted on the basis of experiments in which acoustically presented words and texts read to the subject were used as stimuli. Thomas (**96**) points out the forensic importance of Jaensch's study of personality types. According to him it is especially the I_1-type who is predestined to get into conflict with the existing laws. In experiments on color- and form-preference Ritter (**83**) found a greater integration of psychic functions in the " color-type " than in the " form-type." There was an " affinity to form " in the children with a lesser degree of integration. Dambach (**11**) assumes that color-type and B-type, and

form-type and T-type are intimately related to each other. Pfahler (81) is interested in the relation between the types of Kretschmer and of Jaensch. Jaensch himself points out some differences between the Marburg typology and Kretschmer's system of body form types (37, 38).

EI and Intelligence. In correlating the results of tests for EI with the results of intelligence ratings or with intelligence test scores, most investigators failed to find a positive correlation. As indicated above, Bonte (5) maintains that eidetic cases in general as well as B- and T-types are found on all intelligence levels. Schmitz (89) reaches the conclusion that although eidetic disposition and general intelligence do not correlate, representatives of the "unitary type" are above normal in intelligence if their EI are of the B-type, and below normal if they are of the T-type. She considers intelligence tests as not suitable for determining the intelligence of strong eidetic cases, and especially not of the B-type. In an analysis of 109 answers given in a Binet test about 25 per cent of the answers were based on EI of past events and another 30 per cent on the description of MI of concrete situations. Schumacher (93) thinks that strong eidetic cases with non-fluctuating EI tend to be intellectually somewhat inferior. Liefmann (71) finds that school achievements of eidetic high school girls are neither markedly superior nor inferior. She believes, however, that strong eidetic cases are likely to be inferior in school subjects demanding abstract thinking. Roessler (84) agrees on the whole with Bonte in that general intelligence does not correlate with the eidetic disposition. It may be said, then, that the evidence available at present suggests that there is a positive correlation, not between EI and "general" intelligence, but between EI and some of the functions involved in an intelligence performance. Probably more light will be thrown on the "thinking" of eidetic persons by investigations similar to those by Jaensch and Schweicher (47) than by intelligence measurements. Jaensch and Schweicher present experimental data on the development of "concepts" on the basis of sensory material.

EI and Art. The problems centered around the relation between EI and drawing ability are dealt with in the monograph by Metz (74). On the one hand, EI are successfully utilized in the teaching of art by such men as E. Heckmann; he resorts to colored spots produced with a brush on wet paper, meaningless configurations of lines, or scraps of colored paper to stimulate the color sense and the imagina-

tion of his pupils. On the other hand, it is a fact that even the drawings of children with extremely vivid and very detailed EI have the schematic character typical of the drawings of most children. The question arises as to why eidetic children do not directly rely on EI. Metz agrees with Politt (74, p. 53) that the tracing of contours of EI projected on a surface is impossible, even in cases with very rigid and non-fluctuating EI. The tracing of contours distorts and displaces the EI. From various experiments Metz draws the conclusion that the act of drawing has not a visual but a motor basis. The drawing of a child is essentially a form of language; it simply denotes objects but does not portray their phenomenal appearance. While EI are only of very slight importance for the act of drawing itself they produce, if "cultivated" by teachers of art, an *Einstellung* towards the phenomenal characteristics of visual objects. Here some other facts are pertinent. Subjects verbally instructed to produce at will an EI of a tiger or a flower (without a presentation of such objects) were more successful when a homogeneously colored object was looked at before the instruction than without such stimulation. At the same time, persons were found who at the beginning of the experiments could get EI only from colored objects. The conclusion is drawn that "the color of the EI of visually presented objects has, as contrasted with its shape, a more physiological character." A similar conclusion is reached in Metz' study of "abstraction" (75). Here, too, the reactions to "color" are considered more primitive and, so far as children are concerned, more natural than the reactions to "form." In the light of the studies of Metz and Politt, Schubert's interpretation (91) that the Orotchen drawings "must obviously be interpreted as the outlining with a pencil of eidetic forms which are projected onto paper" does not seem to be justified. In examining 20 artists, painters and sculptors, Joesten (56) discovered only "latent eidetic traces" in the majority of cases; the AI showed a great instability and a remarkable lack of periodicity. Leinweber (69) subjected eight writers and poets to various tests: Rollett's test, the Rorschach test, and tests for determining EI, synesthesia, and symbolic thinking. The results are presented in terms of the Marburg typology (I_1- and I_2-type). K. Gross (19) considers it, on the basis of an analysis of Jack London's novel "Martin Eden," highly probable that the author had pronounced eidetic imagery. Some problems of great interest to the student of aesthetics arise out of the attempt of an eidetic writer

to use EI for the creation of certain effects in his, mostly non-eidetic, readers.

EI and Education. Many educators consider the results of eidetic research of great importance in the analysis of behavior cases in school, in the understanding of markedly inferior or superior school achievements, and in developing didactic methods. Other writers on educational matters believe that the findings on EI are of no consequence for education in general. Whether or not the ability to produce EI can be improved or evoked by training seems to be a further point not yet agreed upon. The value of EI for education and class room instruction has been considered in a number of theoretical discussions, *e.g.*, by Jaensch (27), Kroh (68), Wilhelm (102), Schumacher (92), and Zillig (104). As an experimental study we may cite Schumacher's work (93) on the relation between EI and certain linguistic abilities such as the writing of compositions. It is found that on all intelligence levels the possession of EI, and especially of EI of the B-type, is of great advantage to the child. The study of EI in backward children by Garfunkel (14) and the investigation of feebleminded children by Götz (17) are undoubtedly significant from an educational point of view. Schmähl (88) examined persons with congenital or acquired deafness and those hard of hearing, aged eleven to seventeen years. Only one in the 27 congenitally deaf persons was eidetic. The percentages were higher in the two other groups. Brunswik and Kindermann (10) could not confirm these results.

The Nature of EI. Their Relation to AI, MI and Related Phenomena. Many of the hypotheses underlying the work of the Marburg school are critically considered by Kiesow (57). The one-sided treatment of *visual* EI by Jaensch is criticized. Without taking into account EI in other sense fields and without studying "mixed" cases with EI of different sensory origin, Kiesow believes a true understanding of eidetic phenomena cannot be arrived at. He also believes that EI in childhood are individual peculiarities rather than "normal" phenomena. His comments on Emmert's law based partly on his own research are to the point: "We are still in need of many exact measurements performed under different conditions to settle once and for all the question as to the extent to which deviations from Emmert's law may be regarded as a reliable criterion for the presence of an eidetic disposition." In describing strong eidetic cases Kiesow points out the value of the method of

"graphic reproduction." Recently, we have summarized the facts concerning the "eidetic child" as they appear to us on the basis of our own work and an analysis of the literature (**64**). Jelliffe (**55**) is interested in the relation between "eidetic psychology and psychiatric problems." Siebert (**94**) presenting some experimental data advances the view that everybody may have pseudo- or hemieidetic images. Scharnke (**86, 87**) considers the present findings on EI as of no use to the psychiatrist in dealing with hallucinations; he thinks it is not even clear whether there is any relation between EI and pseudohallucinations. Scharnke also states that he has not succeeded so far in proving beyond doubt the existence of EI in psychotic individuals. Memory-feats, even in feebleminded persons, have been explained quite often by reference to EI (**13, 43**). Gengerelli (**16**) advocates the method of constant stimuli in eidetic research. In the majority of cases, it seems to us, the possibility of employing such a method would indicate that the phenomena dealt with are not eidetic. Allport (**1**) holds a view similar to that of Kiesow in stating that EI are a special variety of MI. Baruch (**3**) believes that the Marburg results on the corporeity of AI and EI are not clear-cut. He describes a method by means of which it is possible not only to obtain tri-dimensional AI, but also to measure the dimensions of such AI. Trendelenburg (**97**) presents some data to demonstrate that such measurements are comparatively exact. Gatti (**15**) also obtained tri-dimensional AI in experiments with 21 adults and 6 children. In Brunswik's study (**9**) of the development of albedo perception the conclusion is reached that "good" perception of albedo and strong EI are correlated. G. E. Müller (**77**) offers an explanation of the phenomenon of simultaneous contrast in EI described by different investigators. The lack of simultaneous contrast in post-hypnotic modifications of visual objects is discussed in this connection. The effects of Anhalonium Lewinii on eidetic and non-eidetic persons are dealt with by several writers (**60, 65, 71**). We have presented some data on "fragmentary" EI (**62, 63**). The facts on fragmentary imagery and on the fragmentary perception of certain pathological cases has led us to assume the importance of "*Gestalt* quanta" in fragmentary reproduction. Bibring-Lehner (**4**) examined the influence of labyrinthic stimulation on the behavior of EI in 29 adults and 5 children. The Bárány test was used. The subjects had to observe the EI before, during and after the rotation. In some experiments

the EI were produced during the nystagmic phase. The changes in the EI taking place under the conditions of this experiment are interpreted in terms of Freudian theories. Bibring-Lehner believes it is especially labyrinthic stimulation which throws "primitive" psychic mechanisms into gear.

EI and the Purkinje Phenomenon. The researches in which the Purkinje phenomenon has been studied must be considered as extremely significant from the theoretical point of view. The investigation of the Purkinje phenomenon in AI and EI by Jaensch and Broer (**6, 7, 8, 28**) has not only thrown new light on the phenomenon itself but also given support to certain genetic views concerning AI and EI. If the effects of photic stimulation on plants and animals are analyzed, it appears that the influence of the longer wave lengths increases as we go from unicellular organisms to man. The hypothesis is evolved that the Purkinje phenomenon represents a revival of a more primitive functioning of the visual apparatus (**8**). The data of Jaensch and Stallmann (**48**) show that the brightness distribution of the Purkinje Phenomenon appears also when the subject is in a state of bodily fatigue. Under these conditions, however, the Purkinje phenomenon is less pronounced when complex visual objects are introduced into the colored areas under observation. The hypothesis, then, is presented that form vision activates higher and less primitive functions than are dominant in fatigue, and that the appearance of the Purkinje phenomenon in fatigue is due to an activation of primordial functions. In discussing the relation between the Purkinje phenomenon and Rayleigh's law, Jaensch (25) considers the Purkinje phenomenon as a phenomenon of adaptation. In the course of phylogenetic development there was on the one hand an adaptation to sunlight and, therefore, to the longer wave lengths; and on the other hand to skylight and twilight conditions, that is to say, to the shorter wave lengths. In the first case there was a brightness distribution predisposing the eye for form vision, in the second case (Purkinje phenomenon) the visual apparatus was set for "optimal" light reception. Heinemann (**20, 21**) presents new quantitative methods for the study of dark adaptation and the Purkinje phenomenon. Children and integrated adults are more easily dark adapted than non-integrated individuals. This does, however, not hold for *Momentadaptation.*

EI and Capillaroscopy. Very extensive investigations on the skin capillaries at the nail bed by means of O. Müller's method of

capillaroscopy (**67, 78**) have been carried out during the last years by W. Jaensch (**50, 51, 52, 53, 54**). Wittneben (**103**), and Hoepfner (**22, 23**), especially in connection with the diagnosis and therapy of goiter, feeblemindedness, and certain neuroses. Hoepfner (**23**) agrees with W. Jaensch that the capillaries of the nail bed go through different phases of development in the first six months of life. The time of six months applies only to "endocrinologically normal conditions" and to districts free of goiter. Hoepfner's study is based on more than 6,000 cases. In the capillary development archi-, meso-, and neo-capillaries are distinguished (**53**). It is asserted that in goitrous regions the population is "biologically" somewhat inferior, a fact to be easily established not by examining goiter but by investigating the capillaries of the children of this population (**52**). The capillary examination is supposed to be part of an all-around medical and psychological examination (**53**). The "optical investigation" suggested by W. Jaensch consists chiefly of tests for the determination of EI. The therapy of cases with retarded capillaries is discussed at length (**103**). It is said that in many cases treatment with glandular extracts has changed not only the form of the capillaries but also the I.Q. Although most investigators agree as to the possibility of identifying the different capillary pictures in terms of Hoefner's "morphogenetic scheme," they hold widely divergent views as to the nature of the somatic and psychic defects correlated with "retarded" capillaries. To us it seems rather difficult to prove that in the last analysis the methods of capillaroscopy detect "ectodermal weaklings," so much the more since the "weakness" of such individuals is supposed to manifest itself in organic as well as in psychic symptoms. In such a way a retardation in capillary development may be easily linked up with any defect for the sake of proving an hypothesis. Furthermore, in the present stage of eidetic research the assumption that the eidetic tests permit of diagnosing "optical infantilism" must be seriously questioned. In most of the above studies the form of the capillaries as seen through the microscope was not photographically reproduced. W. Jaensch (**52**) states that the "total structure" of the capillaries is more important than the details. C. v. Leupoldt (**70**) presents the capillary pictures of 60 schizophrenics and 50 normal persons. There appear to be marked differences between the two groups. It is assumed that "capillary infantilism" is one of the many infantilisms in schizophrenic indi-

viduals. In this connection the study by Miskolczy and Schultz (76) who found 25 eidetics among 50 schizophrenic patients should be mentioned. Again, it is difficult to understand how the eidetic basis of many hallucinations as observed in the clinic could be proved "beyond doubt." Powdermaker (82) reports a marked tendency for a retarded or abnormal development of the capillaries in constitutional idiots and low grade imbeciles in whom there existed a high proportion of physical abnormality. Relatively few primitive forms were found in the moron and high grade imbecile group. W. Jaensch's contention of an intimate relation between eidetic phenomena and certain constitutional types has not found much support in recent investigations (12, 72).

Concluding Remarks. In closing we should like to call attention to some general points bearing on eidetic research.

1. So far as the research of the Marburg school is concerned the emphasis has shifted from the investigation of eidetic imagery to a genetic study of different psychological functions. These recent studies are not primarily concerned with EI, but with the various psychological manifestations of the "total personality." Unfortunately, this shift in emphasis does not mean that the far-reaching conclusions presented in the first researches on the eidetic disposition have been shown to be fully justified in the light of the evidence now available. There is no question that more experimental studies on eidetic phenomena themselves are a desideratum. Instead of new hypotheses concerning the function of EI we need new facts on EI.

2. Such new facts, it seems to us, cannot be arrived at by increasing the number of group investigations. The present writer who has probably, to judge by the studies published so far, examined more cases individually than any other investigator, is well aware of the fact that these individual examinations, especially of strong cases, are very time-consuming. But he is unable to see how group tests for EI, frequently given even to abnormal or very young children, can ever lead to any definite conclusions concerning eidetic phenomena.

3. G. E. Müller (77) in discussing the AI of eidetic or integrated persons points out that the laws for AI can be determined only by paying attention, first of all, to the behavior of AI in non-integrated individuals. If integrated persons report the color of a negative AI to be a color different from the one ordinarily seen we cannot,

according to Müller, attribute any "scientific value" to such a report. In other words: there are some reports which are judged by Müller to be "scientific" and which are utilized—the reports of non-integrated individuals; there are other reports which are judged to be "unscientific"—the reports of integrated persons.

We know of no stronger plea for a complete revaluation of some of the "classical" experiments in the field of physiological optics than this inference of Müller. In investigating visual phenomena of various kinds we frequently find, to be sure, one group of adults whose responses display a certain uniformity and consistency, and another group whose responses are, to use Müller's term, "phantastic." From this we cannot deduce as Müller does that the first group represents the "normal type of adults," but can conclude merely that it is necessary to find out why the difference between the two groups exists and what it means. As a matter of fact, the analysis of the many "abnormal" integrated responses as detected in certain adults and children may be (after a period of research based chiefly on non-integrated adults) of more importance than the analysis of "uniform" responses, not only to psychology in general but also to the investigation of visual phenomena.

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RECENT STUDIES OF TWIN RESEMBLANCE

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The first serious study of twin resemblances like so many other first studies was made by Galton (10). He observed and secured reports on 35 pairs of highly similar and 20 pairs of dissimilar twins and concludes that heredity is decidedly dominant in determining adult characteristics. Thorndike (46) in 1915 went one step further and sought to find the extent to which pairs are alike through a number of mental and physical measurements. Aside from these two studies all noteworthy studies of twin resemblances fall in the past decade. There had been statistical studies of the frequency of twin births (1 in every 85–90 births according to data reported by Dahlberg [7] from eight investigators) and also scattered reports of abnormalities or peculiarities possessed by one or both of a pair, but in addition to the two studies mentioned there was none which would throw light upon the question of the relative influence of nature and nurture in determining human traits, a question which is more certain of solution through the study of twins than in any other manner. This assertion can be made since monozygotic or identical twins have identical or approximately identical heredities, and environments no more nor less alike than those of same-sexed dizygotic or fraternal twins, while dizygotic twins have inheritances no more nor less alike than siblings and environments theoretically more alike in several respects. Comparative studies, then, of the resemblances of identical twins, of fraternal twins, particularly same-sexed ones, and of siblings are calculated to throw light upon the question of the inheritance of traits as well as to answer the question of how great is the actual resemblance in various traits.

Diagnosis of Monozygotism

A difficulty in making these studies is the determination of monozygotism. Identical twins have a common chorion and a common placenta, and consequently an examination of the membranes at birth will disclose the class to which a pair belongs. In continental

countries this information as reported by the obstetrician is included in the birth certificate in many cases, but in this country this information is not available to the investigator. In consequence he must make his diagnosis on other grounds if his study is to be of full worth. The problem of making an accurate diagnosis in the absence of information as to whether there were one or two chorions or placentas has occasioned several articles, notably those of Wilder (**51, 52, 53**), Muller (**25**), Burks (**5**), Siemens (**40**), Komai (**16**), and Newman (**30**). Lauterbach(**20**) and Dahlberg (**7**) also discuss the problem at some length. Lauterbach like Thorndike despaired of determining whether he was dealing with identicals or fraternals, but other investigators feel more confident of their diagnosis. Dahlberg, who makes his determination on the basis of general appearance and of more minute resemblances such as between palm prints and ear formation, states that he has never diagnosed a case as monozygotic when the birth certificate reports the pair as bichorial nor one as dizygotic when the certificate reports a single chorion. Newman (**30**) presents a critical summary of the methods proposed and gives the method followed by himself and collaborators, F. N. Freeman, K. J. Holzinger, and Mrs. B. Mitchell, in their study of fifty pairs of identicals and fifty pairs of same-sexed fraternals. Theirs is perhaps the most exacting diagnosis yet made. They demanded that a pair to be classed as monozygotic must have the same (a) general appearance, (b) hair color, form and texture, (c) eye color and form of iris, and (d) skin color and texture, have no marked differences in (a) features, (b) shape of ears, (c) shape, size and arrangement of teeth, (d) size and shape of hands, and have essentially the same finger and palm ridge patterns. Reversed asymmetry in handedness or hair whorl is taken as confirmatory evidence. In general the rule is that the two twins to be classified as identical must show as much resemblance as is shown by the two sides of the same individual, whether the resemblance of the twins is reversed or same-sided.

It may be mentioned in passing that about 25 per cent of all pairs have been found through examination of the birth membranes to be monochorial. Dahlberg (**7**) gives the results of some twenty statistical studies dating from 1860–1916. The percentages range from 11 to 35.6. In several instances the calculations were vitiated by including as bichorial cases not examined, and so Dahlberg, choosing the most reliable studies and correcting the calculations of some, places the

percentage between 20 and 30 with the probability that it is close to 25. This checks closely with theoretical calculations from the relative number of same-sexed and opposite-sexed pairs. If an equal proportion of girls and boys in the population is assumed, twins should theoretically be distributed in the ratio 1BB; 2GB: 1GG. Actually the ratio is approximately 31:38:31. The predominance of same-sexed pairs must be attributed to the presence of monozygotics, and when subtraction is made for these cases, their per cent comes out as approximately 24. This means that about 38 per cent of same-sexed pairs are identicals.

Reversed Asymmetry or Mirror Imaging

In connection with the determination of identity it may be well to mention asymmetrical reversal which has received considerable attention because of its frequent occurrence with polyembryony in animals other than man. Dahlberg (7) and Newman (31) summarize the data and discussion concerning this phenomenon. It has become apparent that mirror imaging frequently occurs in identical twins but is by no means always associated with identity. For instance in only about 22 per cent of identicals is one of the pair left handed. This is not much higher than the per cent in fraternals—16. Both these percentages are much higher than the percentage of left handedness in the population at large—between 4 and 5 per cent. These values for twins are obtained from the findings indicated below.

	Identicals			Fraternals		
	R-R	R-L	L-L	R-R	R-L	L-L
Siemens (37)	26	10	1			
(38)	?	27	3			
Weits (49)	10	7	1			
Dahlberg (7)	53	12	4	111	16	1
Vershuer (47)	58	15	5	28	10	0
Newman et al. (31)	38	12	0			

Newman (31), who used the tapping test as an indicator of left handedness concealed by training, found concealed or partial left handedness in thirteen of the 38 pairs listed as R-R above. These thirteen pairs were distributed as follows: 7 cases, one right handed and the other partially left; 3 cases, both partially left; 1 case, one partially left and the other ambidextrous; 2 cases, both ambidextrous. If this diagnosis of left handedness and ambidexterity be accepted, Newman's findings are 25 R-R, 19 R-L, 3 L-L, 1 L-A, and 2 A-A,

or 50 per cent with some left handedness. It is interesting to note further that left handedness in one twin appeared in those of Newman's cases in which physical resemblances were least.

Lauterbach (**20**) reports 35 per cent of his 102 cases as showing left handedness in one twin and a similar per cent exhibiting reversal of hair whorls. Newman (**31**) finds the per cent of reversed hair whorls equal to that of left handedness, but not every case of reversed hair whorl occurs in cases in which one of the pair is left handed.

Trait Resemblances

A. Anatomical Measures.

Thorndike secured the following correlations for physical traits of 39 of his 50 cases: height, 78*; sitting height, 83; sitting height/height, 76; width of head, 86; circumference of head, 75; cephalic index, 76; finger length, 71; forearm length, 72. Although he found a marked skew in his distribution of the closeness of resemblances, he decided against dividing his cases into identicals and fraternals. His chief reason was that he found little correlation between resemblance in one trait and resemblance in another, *i.e.*, when the fifty pairs were arranged in order for their similarity in one trait, the order of another trait was so different as to give a low correlation.

Danforth (**8**) records the results of a questionnaire sent out to a large number of twins.

Holzinger (**14**) in reporting the collaborative study with Newman et al. gives the following values for r for same-sexed fraternals and for identicals respectively: height, 65 and 93; sitting height, 50 and 83; weight, 63 and 92; head length, 58 and 91; head width, 54 and 89; cephalic index, 58 and 89; finger ridges, 46 and 97. The mean differences in height are 1.7 and 4.4 (cm.?)), for cephalic index .02 and .03, and for finger ridges 3.4 and 22.4. Holzinger presents two formulae for determining from these values the relative influence of heredity and environment, finding that heredity is decidedly more influential than environment in determining finger ridges and somewhat more in determining other anatomical characteristics.

Dahlberg (**7**) made 15 anthropological measures on 243 pairs and reports his results in terms of the mean differences. When the means of all measures are averaged, his results in millimeters are

* Decimal point omitted in all values of r.

as follows: measuring error, 2.98; identicals, 3.22; same-sexed fraternals, 19.82; opposite-sexed fraternals, 23.75; brothers of the same age (measured at different times), 19:59. In height the mean difference is 15.3 mm. (1.1 per cent) for identicals and 50.7 (3.5 per cent) for same-sexed fraternals, in head length 2.6 (1.4 per cent) and 5.4 (3.0 per cent), and in head with 1.7 (1.2 per cent) and 4.0 (2.7 per cent).

Vershuer measured a number of identicals using somewhat the same set of measures as Dahlberg. His values are considerably lower than Dahlberg's. In fact in several cases they are lower than Dahlberg's measuring error, and so Dahlberg is led to suspect that in too many cases he remembered while measuring the second of a pair the value for the first. The mean difference for height he found to be 9.2 mm., for length of head 1.7, and for width of head 1.2.

Lauterbach in his study of 212 pairs obtained the following correlations for like-sexed and unlike-sexed respectively: height, 80 and 53; sitting height, 73 and 59; weight, 89 and 50; cephalic index, 67 and 59. These values are considerably lower than Holzinger's, as they should be from the nature of the classification. The one exception is the cephalic index for unlike-sexed twins, and here the sex difference as such is eliminated.

Sheidt (**42**) reports physical measurements of 13 pairs; 7 identical, 3 fraternal, and 3 doubtful.

Wilder's early studies of palm and sole patterns are noteworthy in as much as it has since been found that, as he contended, these patterns give the most reliable indication of identity of any single measure. Poll (**35**), Bonnevie (**3**), and Ganther and Rominger (**11**), also report studies of palm patterns. Lauterbach (**20**), in supporting his refusal to classify into identicals and fraternals, cites two cases of opposite-sexed twins with almost identical palm patterns and with other measures highly similar.

If the question of the determination of identity may be opened again, it may be remarked that Dahlberg, like Thorndike, found low correlations (13–46) between traits but does not consider this as invalidating his diagnosis.

B. Intelligence.

Holzinger (**14**) reports the following values of r: Stanford-Binet M.A., 60 for same-sexed fraternals and 86 for identicals; Stanford-Binet I.Q., 63 and 88; Otis Self Administering Score, 57 and 90; Otis I.Q., 62 and 92.

Wingfield (**56**) using the Stanford-Binet obtained 72 for fraternals, 90 for identicals, 62 for unlike-sexed, 83 for like-sexed, and 76 for all twins.

Merriman (**24**) using 102 pairs as subjects found r's as follows: Stanford-Binet I.Q., 50 for unlike-sexed and 87 for like-sexed; Army Beta, 73 and 90; National, 87 and 93; teachers' estimates, 27 and 65. Shen (**41**) criticizes Merriman for not correcting for age. He shows that if unrelated children are paired by age a correlation near 25 will be obtained. As far as the reviewer can determine the same criticism might be raised against most other studies, but the correction would not alter the relative heights of the correlations for various classes of twins.

Lauterbach (**20**) secured 77 and 56 for like- and unlike-sexed twins using the Binet I.Q.

Tallman (**44**) reports his findings in terms of the mean differences in Binet I.Q. These values are 5.08 for identicals (5.33 obtained by Newman et al., Newman 1929), 6.42 for same-sexed twins, 8.48 for unlike-sexed, 7.07 for all twins, and 13.14 for siblings. The random difference is about 22 ($\sqrt{2} \times Q$).

The average I.Q. in the above studies of twins of school age are: Merriman, 96; Lauterbach, 95; Wingfield, 97.2; Holzinger, 101; and the distribution is approximately that found by Terman for children at large. J. E. Anderson in a report before the Midwestern Psychological Association at its 1928 meeting gave data to show that twins under five are significantly lower in I.Q. than other children.

Gesell's one case (**12**) is especially noteworthy since the I.Q.'s were 183— and 183.

It will be noted that the r's for identicals are slightly lower for intelligence tests than for anatomical measures, and for same-sexed fraternals they are higher for intelligence tests than for anatomical measures. As Holzinger (**14**) with the aid of his formula clearly shows, this means that environment is more influential in determining intelligence test score than in determining anatomical characteristics.

C. Educational Tests and School Marks.

Holzinger (**14**) reports the correlations for the five parts of the Stanford achievement test and for the combined score or EA. The average of the former is 69 for fraternals and 82 for identicals, and the values for the latter are 70 and 89. The mean difference in EA was found to be 6.5 mo. (6.2 according to Newman 1929) for identicals and 11.6 for same-sexed fraternals.

Lauterbach (20) secured r's of 59 and 56 for like- and unlike-sexed twins for the Thorndike-McCall Reading Quotient and 59 and 29 as averages of the ten r's obtained from the various parts of the Courtis Arithmetic Test.

For Wingfield's results with educational measures see under "comparison of younger and older twins" below.

Waardenburg (48) reports the following data on scholastic marks:

29 dissimilar pairs		
17 pairs	(58.6%)	great differences
6 pairs	(20.7%)	slight differences
6 pairs	(20.7%)	insignificant differences
45 identical pairs		
0 pairs		great differences
8 pairs	(17.2%)	slight differences
37 pairs	(82.8%)	insignificant differences

There have been several studies of the resemblances of siblings in educational tests (see Starch, *Educational Psychology*), but the reviewer is not familiar with any which will give an exact comparison with the above studies of twins.

D. Personality Traits.

Waardenburg (48) from his observations reports considerable differences in emotions and will, likes and dislikes, and desires, with scarcely any distinction in amount of dissimilarity shown by fraternals and identicals.

Danforth (8) in his summary of the replies of twins to a questionnaire includes comments with reference to personality resemblances.

Holzinger (14) reports the following r's for personality tests or ratings: Woodforth-Mathews questionnaire, 56 and 37 (identicals and same-sexed fraternals); Downey judgment, 31 and 37; Downey motor index, 51 and 53; Downey coördination impression, 48 and 51. Freeman in reporting the personality phase of the Freeman, Holzinger, Newman, Mitchell study at the 1929 meeting of the A.A.A.S. concludes that the personality differences are much more marked than the physical and intellectual differences.

E. Miscellaneous Tests and Measures.

Thorndike (46) found an average correlation of 78 for his six perceptual tests.

Kramer and Lauterbach (17) report a greater resemblance in

the quality of the handwriting of like-sexed than in that of unlike-sexed twins and a greater resemblance in that of unlike-sexed twins than in that of siblings. Lauterbach (**20**) obtained correlations of 69 and 37 for handwriting quality in these two classes of twins and of 83 and 37 for writing speed, using the Kansas City Handwriting Scale. The r for siblings found by Starch is 46.

Lauterbach (**20**) secured 40 and 25 for his two classes of twins in memory for digits.

Holzinger (**14**) reports 69 and 36 for his two classes of twins in speed of tapping.

Iowana (**15**) reports that identicals never show a difference in diffraction of the eyes greater than 1 D, while differences greater than this are frequently found in fraternals. It might also be mentioned that both the Grosvenor twins and both the B twins reported in the special twin number of the Journal of Heredity (1919, 10, No. 4) are dependent on glasses, the glasses of one twin being interchangeable with those of the other twin.*

Macfarlan (**22**) measured the auditory threshold through the frequency range in one set of identical twins and found an almost exact correspondence.

Abnormalities

A. Developmental Anomalies.

Shattuck (**43**) finds that 33 cases of mongolism in one of a pair of twins have been reported and holds that in some cases the pairs were identical. Chowne (**6**) reports a case in which he feels certain of the identity.

Leavitt (**21**) reports a case of cerebellar tumor of like nature in both of a pair and refers to other cases.

Reports of peculiarities and anomalies possessed by one or both of twins are so numerous that no attempt will be made to mention all. Wilson and Wolfsohn (**55**) cite many instances and state that an anomaly of development is always similar and equivalent in identicals. Siemens (**39**) has collected many cases possessing naevi and holds that these peculiarities are inherited.

B. Resistance to Disease.

Opinions and observations with reference to the equality or

*One of the B twins reported by Wilder in this issue is the wife of the reviewer, and so this interchangeability of glasses with her sister may be safely mentioned even though it was not noted by Wilder.

inequality of resistance to disease are also frequent in the literature, but the criteria for judgment are so vague and the observations so limited that mention will be made only of the book by Siemens (37) and the articles by Averill and Mueller (1), Bliss and Perkins (2), and Murray (27).

C. Neuroses and Psychoses.

Siemens (37) finds 17 recorded cases of dementia praecox in both of twins. Of these he says 6 were most certainly identical, 6 fraternal, and the others undetermined. The onset was simultaneous for 3 of the identical pairs, a year apart in another pair, and the records lacking for the other 2 pairs. Franz (9) reports another case in which the onset was simultaneous. Parker (34) feels reasonably sure that Franz' pair was identical and also reports another case which he classified as identical.

Lange (18, 19) holds on the basis of his studies that epileptic taints and the cyclic forms of insanity work out equally in both of a pair of identicals. He reports some interesting cases as do also Targowla (45) and Marie and Marie (23).

Comparison of Older and Younger Twins

Thorndike (46) found an average correlation of 83 in his six perceptual tests for twins nine to eleven and of 70 for twins twelve to fourteen.

Lauterbach (20) found in several comparisons a greater resemblance between younger pairs than between older ones, but also in several traits a greater resemblance between older ones. His average correlations were 54 for younger and 55 for older on mental tests and 63 and 62 on four physical measures.

Merriman (24) found an r of 77 in intelligence tests for twins five to nine and 67 for those ten to sixteen.

Holzinger (14) presents the following data in terms of mean differences.

	Identicals		Fraternals	
	younger	older	younger	older
Finger ridges	3.2	3.6	21.7	22.9
Height	1.7	1.6	4.4	4.4
Binet M.A.	7.2	9.8	10.6	19.9
Stanford E.A.	5.5	7.5	6.5	15.1

After a critical examination of these data he concludes that heredity and environment maintain their relative amounts of

influence. If there is any change with age, the influence of heredity becomes slightly greater with increasing age.

Wingfield (**56**) supplies the following r's obtained from his 102 pairs: Binet I.Q., 71 for those eight to eleven and 77 for those twelve to fifteen; Stanford E.Q., 64 and 87; Stanford A.Q., 82 and 72; Arithmetic, 89 and 73; Spelling, 85 and 85; averages, 78.2 and 78.8.

Dahlberg (**7**) divides his cases into three age groups, under ten and a half, ten and a half to fifteen and a half, and above fifteen and a half, and finds that the physical differences calculated in pro mille become slightly greater in identicals as age increases but not in fraternals.

Vershuer (**47**) reports no significant difference with age in physical measurements.

It would seem from these studies that little is to be expected from comparisons of younger and older twins in settling the question of the relative influence of heredity and environment. The most probable reason is that heredity and environment maintain their relative amounts of influence whatever the amount of either one may be.

Identicals Reared Apart

The most interesting and perhaps most valuable of all twins for study are identicals who have been reared apart. Wiggam (**50**) reports the contents of letters which he has received from two twins reared apart. Marked similarity in all respects is reported, but it is well known that twins emphasize their similarities rather than differences. Popenoe (**36**) gives a report of correspondence with another pair. Muller conceived the idea of measuring and testing this pair reported by Popenoe. His results together with those of Newman (**33**) who has reported measurements of three of five pairs which he has discovered are shown in tabular form on the following page.

All pairs were separated before the age of two and remained separated until after they were eighteen. In Muller's case the two homes were highly similar in social and economic status. In Newman's first case the difference in the social and economic status of the two homes were rather marked. This was also true in his second case but not in his third. This is noteworthy in view of the established effect of economic and social standing of the homes upon the I.Q.'s of siblings reared apart. The differences of 12 points in I.Q.

	*A.D. for identicals	Muller's Case		Newman's Cases					
				Case 1		Case 2		Case 3	
		B.	J.	A.	O.	E.	G.	C.	Q.
Anatomical measures									
Height	1.7cm	½"	dif.	61.6	61.8"	58	59.1"	62.8	62.4"
Sitting Height	1.5cm			33.3	32.6"	31.4	31.9"	33.5	33.4"
Weight		same		92.1	102			124	113.4
Head Length	.26cm			17.5	17.9	17.7	17.75	18.6	18.4
Head Width	.17cm			13.6	13.8	14.2	14.1	15.3	14.3
Finger Ridges	3.4			71	71	79	82	102	106
Intelligence tests									
Binet M.A.	8.4 Mo.			13-7	15-6	10-6	12-5	15-11	16-2
Binet I.Q.	5.33			84.9	96.9	65.6	77.6	99	101
Army Alpha		156	153						
Thurstone				18%ile	60%ile			35%ile	17%ile
International				111	173	70	98	156	146
Otis S.A.-I.Q.	4.5	Note 3		90	108	69	84	110	100
Educational tests									
Stanford E.A.	6.2 Mo.			15-1	16-8	10-11	14-1	17-11	15-9
Personality tests									
Woodworth-Mathews	5.5					18	26	13	15
Kent-Rosanoff				120	110	79%ile	95%ile	163	133
		70	57	39	53	56	59	55	61
Downey Will-temp	Note 1	A.D.	=4	A.D.	=2¼	A.D.	=3	A.D.	=1.7
Pressey X-O	Note 2	160	249	154	150	53	75	161	257
Motor tests									
Finger tapping		207	164	148	154	E al	ower	162	171

* The first four values of column 1 are taken from Dahlberg (7) and the remaining from Newman (33) and Holzinger (14).

Note 1.—A.D. for unrelated individuals is 3.5, average score is 66.

Note 2.—$Q_1 = 200$, Md = 230, $Q_3 = 260$, A.D. for unrelated individuals = 42.

Note 3.—The scores were 64 and 62 which are exceedingly high, as are the Army Alpha scores of 156 and 153.

of Newman's first and second cases was exceeded by five of the fifty identical pairs used in the collaborative study.

Monozygotic Triplets

In securing these data on twins the reviewer came across three references to monochorial (monozygotic?) triplets. R. Santer (Zrschr. f. Geburtsch., 1901, Bd. 46) finds reference to eight cases. Dahlberg (7, page 63) refers to a case reported by W. Hust, and A. E. Clarke and D. G. Revell report a case (Journ. Hered., 1930, 21). It might also be mentioned that the frequency of triplet births is 1 in $(80\text{–}90)^2$ according to data summarized by Dahlberg (7).

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PSYCHOLOGY OF MUSIC

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Tonal Attributes

A certain amount of the work on tonal attributes has a direct bearing on the psychology of music. Seashore (202) takes the position that the four ultimate tonal attributes, basic for all musical effects, are pitch, quality or timbre, intensity, and duration. These he regards as arising from the physical properties of the sound wave, to which he insists we must return for any scientific account of musical phenomena. As early as 1904, however, Meyer (134) had advanced the view that these are not all independent attributes, but in some cases are separable for convenience only. Today we find significant divergencies from Seashore's position among various workers, and in particular an insistence upon the importance of tonal volume. Rich (170) in a review of the literature of tonal attributes, holds that there are but three—pitch, volume, and tonality (*i.e.*, c-ness, g-ness, etc.). In passing we note the variant uses of this term. Ogden (151) presents an account of the tonal manifold in which pitch is not one of its dominant independent characteristics, and according to which the four sensory qualities of sound are pitch-brightness, volume, intensity and duration. Watt (249) has worked out an elaborate account of musical phenomena in which the element of volume holds a central place. He explains intervals and fusional effects largely in terms of volumic balance. Ruckmick (177) schematizes tonal attributes as a tonal bell and says that in the Iowa Laboratory the Os designate volume only metaphorically as a rule. Ogden (152) agrees with Watt that in intervals and fusional effects, volumic balance, as contrasted with liminal pitch discrimination, is the determining factor, but cites the work of Rich (169) to show that Watt's symmetrical schematization of tonal volumes is untenable. He criticizes the Seashore tests as ignoring the volumic factor. Rich (169) has shown that the differential limen for volume does not coincide with that for pitch, and has argued that volume is an independent attribute, though Dun-

lap (40) questions the relevancy of his results to such a conclusion. Köhler (99) has urged the importance of tonal body, and suggests that too much attention has been attracted to pitch. Belaiew-Exemplarsky (10) finds that tonal volume or body is basic in the musical experience of young children.

From the Iowa laboratory have come a number of studies dealing with pitch, and the measurement of its differential limen. Seashore (201) shows that for this purpose the tones should be rich, constant in intensity, and loud enough to be easily heard. The influence of intensity, order, duration, and absence of distraction was studied by Anderson (5), Hancock (72), and Stewart (223), while Smith (209) showed that pitch discrimination gives a meager response to training, and analyzed the factors involved in the improvement of this function. Vance (241, 242) investigated variations in pitch discrimination within the tonal range, and the lower limits of tonality.

The work on absolute pitch serves to emphasize the complexity of the phenomenon both in its psychological basis and as an index of musicality. Stumpf (234) attributes it to practice effects, general retentiveness, and an unexplained individual coefficient. Boggs (18) finds its basis in the qualitative differences in tones, and the direction of attention to isolated tones. Baird (7) concludes that it originates largely in vocality. Watt (249) regards it as essentially a localization in the series of tonal volumes. Ogden (151, 152) thinks it is due to perceptions of differences of pitch-brightness and volume within the octave. Köhler (99) insists that it does not arise exclusively from the sense of pitch. Gough (65) recognizes the significance of non-pitch factors in the introspections of her subjects. Together with Von Kries (243) she has clearly recognized that it may exist in varying degrees of excellence. Révész (165, 167) finds that there are two types of absolute pitch judgment, one based on pitch, the other on quality (*i.e.*, for him, g-ness, c-ness, etc.), that it may exist in many degrees of excellence, and that it differs for different parts of the tonal range. Boggs (18) and Baird (7) both find a positive relation between promptness and correctness of judgments of absolute pitch. Gough (65) has shown at length that it can be produced by training, a conclusion emphatically substantiated by Mull (145) and supplementing the earlier work of Meyer (133). Abraham (1) finds the great difficulty in acquiring it in the associative paucity of tones. Rupp (186) has proposed various

interesting techniques for its measurement. Révécz (164) suggests that it indicates unusual musicality.

Musical Rhythm

Only a small proportion of the numerous studies on rhythm deal in an intimate and specialized way with rhythm in music. The reason of course is that we are dealing with a mental function whose significance is only partly exhausted by its musical manifestations. The point is well indicated in two papers by Ruckmick (182, 183) in which he shows the relation of rhythm to other forms of perception, particularly kinesthesis, and to attention. Buecher (24), too, finds the origin of music in the general rhythmic interest of primitive work activities. Ruckmick (176, 174, 175, 176) in a bibliography of 741 titles assembles most of the rhythm studies. Dunlap (39) and Woodrow (257) also present summaries of and comments upon the rhythm literature. Among the pieces of experimental work dealing more or less with specifically musical rhythm we have the two extensive papers by Stetson (219, 220) in which he formulates his ingenious and convincing motor theory of rhythm. Bingham (17) working along similar lines, points out the close analogy between the rhythm experience and the melodic experience. Stetson and Tuthill (221) show that the presence of rhythmic factors cause time deflections in the reactions of highly trained musicians. A similar problem is investigated by Sears (195) and by Morton (143). Ross (172) makes a study of the time sense as a factor in the sense of rhythm. Hallock (71) finds that the rhythms of musical compositions are dominated by a beat falling within rather narrow limits of speed. Sterzinger (218) investigates the rhythmic effects of musical intervals successively given. In a previous paper (217) he found a correlation of .71 between the rhythmic value of successive intervals measured by Woodrow's rhythm indifference point method, and judgments of pleasantness. This finding seems somewhat in conflict with the results of Woodrow (256). Myers (146) studies the gong rhythms of the Sarawak Malays, and Jackson (83) analyzes the rhythmic structure of German folk music, two papers of considerable psychological interest. Dixon (37) investigates the emotional effects of some extensive rhythmic structures. DeGraff (34) and Klauer (92) find that rhythmic discrimination as measured by the Seashore rhythm test is not much affected by training, and conclude that we have to do with an innate ability. Niel-

sen (149) obtains similar results with the motor rhythm test of R. Seashore (206), Jaques-Dalcroze (84) discusses in a nontechnical manner a number of aspects of rhythm, and a group of studies of somewhat similar interest are brought together in the report of the first Rhythm Congress held at Geneva (28).

Consonance and Interval

We pass now to the more complex musical-mental phenomena. The earlier work on consonance and interval effect has been so well summarized in a number of readily available publications, notably by Guernsey (67), Malmberg (124), Moore (141), Ogden (152), Peterson (157) and Watt (249), that it calls for no more than passing reference here. Apart from the well known and classic view of Helmholtz which explains dissonance as due to beating partials, we have Krueger's (103, 104, 105) explanation in terms of difference tones, that of Lipps (118) in terms of micropsychic rhythms, and that of Stumpf (231, 234 *et al.*) in terms of tonal fusion, which is based on by far the most extensive experimentation. So many difficulties have been pointed out in all these views, that probably few psychologists would now accept any of them unmodified. Apart from the more or less *a priori* but still convincing objections that have been urged, the demonstration of fusional and other effects in non-musical intervals constitutes a still further difficulty for the older accounts. Thus Bries (21) found four non-musical intervals possessing higher fusional values than the perfect fifth. To this we must add the work of Emerson (42) and of Guthrie and Morrill (68), while the researches of Pratt (161) and Werner (254) on quarter-tone music and micro-music may be interpreted along the same line.

We may sum up the more recent work under the following heads: *1. Multiplicity of criteria:* Guernsey (67) has shown that our reaction to intervals is governed by fusion, smoothness, and unpleasantness and that these are more or less independent. Pratt (162) found that his Os ranked intervals differently for roughness, simplicity-complexity, and pleasantness-unpleasantness. Kemp (90) finds four different effects of bitonal clangs, namely fusion, sensory agreeableness, sensory conformity, and harmonic conformity. Heinlein (74) argues that a number of factors, the most important of which are pleasantness-unpleasantness, affect the judgment of consonance in paired comparisons. Farnsworth and Voegelin (52) show that intensity modifies dyad preferences.

In effect this multiplicity of criteria is accepted by Malmberg (124) who employs the criteria of blending, smoothness and purity, and by Seashore (197, 202). *2. The influence of learning, experience and tradition:* Valentine (239, 240) shows that the interval preferences of school children differ significantly from those of adults, and that practice is a potent factor in evaluating discords. Moore (141) presents a genetic account of consonance, according to which racial experience modifies our valuation of intervals, and supports his claim by experimental results on practice effects. Ogden (150, 152) thinks that individual experience cannot account for the facts of consonance and dissonance, and postulates a factor of racial adaptation. Peterson (157) criticizes this view, and explains the system of interval preferences largely in terms of musical tradition and use. *3. Abandonment of the antinomy between consonance and dissonance:* Guernsey (67) considers that the distinction between consonance and dissonance is not absolute. Watt (249) would substitute the concepts of symphony, paraphony, and diaphony for consonance and dissonance. The work of Moore (141) indicates that no absolute distinction is possible between consonance and dissonance. Heinlein's (74) work too may be cited as another instance of the abandonment of the consonance-dissonance antinomy.

All in all we seem to be confronted with a tendency to regard interval as a configurational phenomenon depending on many factors, and unstable alike in its outlines and its affective values. Watt (249) regards interval preferences as depending on volumic rather than pitch perception, and Ogden (152) supports this view, pointing out that the pitch value of an interval may be considerably modified without altering its phenomenological character. Pratt (159, 160) indicates that the sense of interval is to be distinguished from that of tonal distance. Edmonds and Smith (41) find a surprising regularity in independent phenomenological characterizations of intervals, which suggests that each possesses a unique *quale*. Moran and Pratt (142) and Hohenmeser (78), among others, have shown that small variations in size of intervals do not change their essential character as thirds, fifths, etc., a result which Ogden explains as due to the differential limen for volume not coinciding with that for pitch. Some difficulties in the way of Watt's volumic theory of interval are revealed in a paper by Farnsworth (47) who shows that with increase of musical training there goes an increasing tendency to

judge the pitch of a combination of tones as the pitch of the upper tone.

Applications of some of the findings on consonance and interval to harmony have been attempted by Waiblinger (246), Ogden (152) and Watt (249), of which the last is the most extensive.

Melody, Scale, and Key

Meyer (137) criticizes the Lippsian theory of melody as presented by Weinman (251, 252), and also the account of tonal sequence based on the "diatonic fallacy" of Helmholtz, which reappears in the work of Stumpf (225), and which eliminates the ratio symbol 7. He develops his own account of melody based on the two principles of melodic relationship arising from the prime numbers up to 7, and of finality or tonic effect, constituted by a return to the ratio symbol 2 or one of its pure powers (130, 131, 132). From his melodic relationships, Meyer develops a "complete musical scale" of 29 subdivisions within the octave, and transposes a number of melodies into this system. Wead (250) and Ogden (152) criticize Meyer's system of melodic relationships as the work of but a single observer harmonically trained. Ogden (152) insists on the law of equal intervals as governing the sequences of tones, which finds support in Watt's (248, 249) demonstration that the smaller intervals are preferred in melody. Ogden (152), Meyer (131), and Bingham (17) study finality effects arising from return to the pure powers of 2, and of falling inflection, Bingham adding a law of return. Farnsworth finds a certain finality value in the ratio symbols 3, 5, and 7 (44, 45). He shows that repetition modifies the system of ending preferences (50), and contends that many of the finality effects of the scale are due to habit. For Meyer (131) and Ogden (152) the scale is a secondary musical phenomenon deriving from melody, and Ogden elaborates an account of the evolution of the tempered scale through the principle of equal interval, and harmonic effects. For Watt (249) the selection of tones to form scales results from familiarity and social necessity. He holds that music begins with melody; then comes the emergence of the scale; this leads to polyphony which engenders harmony, and last of all comes tonality or key which reflects back and modifies all the rest. Tonality for him is like a new motion or melody of all the unthematized voices, while for Bingham (17) it is a system of expectations, due largely to habit. Kühn (107) regards feeling for

tonality (*i.e.*, key) as a mark of musicality in children. Bingham (17) sets up an account of melody contrasting with that of Meyer, in that melodic unity is not constituted by relationship but by aesthetic wholeness, which registers and can be detected in our voluntary reactions. This viewpoint, which is characteristic of the newer work, finds support in a study by Humphrey (82) on conditioned reflex responses to auditory stimuli, and is represented in effect by Heinlein (75) for whom melodic configuration is important, and by Ortmann (153) who discusses the relationships between the melodic totality and the constituent tones. Belaiew-Exemplarsky and Jaworsky (13) insist upon the total impression of the tone complex in melody, and contend that even finality effects are to be grasped in relationship to the melodic configuration. Thurstone (238) explains the aesthetic power of melody on the ground of the motor basis of pitch perception. Heinlein (77) in a paper with a very well-organized account of the literature, discusses the major-minor problem, and finds no distinctive and inherent affective character of sadness attaching to the minor. Valentine (239) finds no marked affective character in minor chords for children and adults. Farnsworth (49) finds no constant attribute of sadness in minor broken chords. Ogden (152) points out that much exotic music in the minor mode is essentially joyful, and Watt (249) regards the difference between the major and the minor as due merely to the relative prominence of major and minor intervals. Pear (156) has argued that the distinction between the major and minor triad lies in the lesser fusion of the latter, a conclusion disputed by Waiblinger (245).

Musical Emotion: Listening and Appreciation

Beaunis (8) discusses the derivation of musical emotion from the factors of rhythm, duration, intensity, pitch, and timbre, and emphasizes the importance of mental adaptation to music. Weld (253) finds the sources of musical pleasure complex, arising from timbre, rhythm, associations, imagery in various modalities, and the grasp of musical structure. Washburn (247) attributes the origin of musical feeling to ancient social adaptations. Seashore (196, 199) contends that the scientific investigation of musical emotion must proceed from the idea that it involves artistic fluctuations from regularity. Belaiew-Exemplarsky and Jaworsky (13) attribute the expressive value of melody to the introduction of new and unexpected elements which yet can be assimilated to the total configuration.

Roberts (171) records varied renderings of the same melody by an Indian singer. Schoen's (191) questionnaire replies indicate the intensive character of musical emotion. He emphasizes the non-representative nature of music, which implies that it cannot express or evoke specific emotions, but rather general moods. The same point is developed experimentally by Sherman (207) who shows that an accomplished singer could not convey to listeners with any precision an intended emotion by singing a single note. Papers brought together by Schoen (192) deal with the sources of affective reactions to music, music in relation to mood, and the relation of musical emotion to more general musical enjoyment.

Musical emotion has been connected with the vascular effects of musical stimulation. Diserens sums up the experimental work on these effects (36), and shows that they are just such as are required by the somatic theory of emotion. In a later work (35) he largely expands his summaries, drawing material from animal psychology, anthropology, musical therapy and the effects of music on work and fatigue, and adding an extended report of his own experimental work. One of the papers edited by Schoen (192) deals with the organic effects of music. Weld (253) has made pneumographic and plethysmographic studies of the effects of music. Erickson (43) traces a relation between Cannon's account of pleasure-pain in terms of the reciprocally inhibitive action of the cranial and thoracico-lumbar divisions of the autonomic and the value of a pleasing feeling tone in singing. Gatewood (56) contributes a study of the effects of music in an architectural drafting room, using the questionnaire method, and showing in general favorable effects of music on this type of work.

Turning to the related topic of music appreciation and the psychology of listening to music, Downey (18), Gilman (62), and Weld (253) present reports of the experience of persons listening to music. Weld (253) undertakes a classification of types of listeners. Schoen (191) discusses types of attitudes in listening to music, a topic to which a paper in the collection edited by him (192) is devoted. Ortmann (154) presents a somewhat *a priori* account of the sensorial basis of music appreciation. The effects of repetition, familiarity, and sequence of selections on musical enjoyment are dealt with in papers in Schoen's collection (192). Whipple's (255) work with the reproducing piano suggests the extent to which even trained musicians fail to hear the precise details of an effect.

Brennan's (20) results indicate that musical expertness decreases the range and alters the basis of evaluations of performance. Katz and Révécz (89) instructively discuss the case of Sutermeister, who became deaf but discovered a continued power of musical enjoyment. Adler (2) devises a method of measuring music appreciation.

Learning in Music

The work on musical learning is meager. Gordon (64) compares the learning of musical themes and the learning of nonsense syllables in series containing as many items as there are notes in the melody, the aim being to ascertain to what extent this type of musical learning depends on meaning. Kovácz (102) sets up an experiment to investigate two methods of memorizing music. Elsewhere (101) he distinguishes between the nature and function of reproductive and recognition memory for music, in terms of the type of attention and imagery involved. Juhácy (87) studies musical recognition, using series of nonsensical phrases of three tones, which he regards as analogous to nonsense syllables. Heinlein (75) insists on the importance of melodic configuration in the musical memory-span. König (100) investigates memory-span for tones among musicians and non-musicians, the former showing a decided superiority. Smith (209) formulates some of the psychological conditions of "ear-training." Brown (23) studies the whole, part, and combination methods of learning piano music.

Singing

For Stumpf (233) the distinction between singing and speech is relative, song involving discrete tonal steps, while speech is a tonal continuum. Erickson (43) discusses at length the vocal coördinations required to produce effects of pitch, intensity, and timbre, and analyzes the higher mental processes involved in the act of song. Stevens and Miles (222) make a study of the special problems of the vocal attack, and the conditions for its maximum accuracy. Substantially they agree with the conclusions of Beaunis (9) based on his work with singers whose vocal chords had been anaesthetized, to the effect that voice is not primarily controlled by muscular sensations from the throat. The problem of the accuracy of a sung tone, its conditions, and the extent to which it can be improved by practice is investigated also by Berlage (14), Cameron (25, 26), Kerpola and Walle (91), Klünder (92), Miles (138), Schoen (188), and

Sokolowsky (210). Careful studies of the vocal vibrato, ". . . an observable periodicity of pitch or intensity pulsations or both . . ." have been made by Kwalwasser (110), Metfessel (129), Schoen (188), and Wagner (244), the general outcomes being that vibrato is a legitimate element in artistic singing, that the ideal of vocal control is by no means a mechanical uniformity, that vocal training often operates to increase the amplitude and regularity of the vibrato, and that it is to some extent susceptible of direct training and voluntary control. Knock (94) and Seashore and Jenner (204) investigate the effects of visual training on vocal control, using the tonoscope. Metfessel (128) elaborately analyzes the technique of phonophotography.

Music Tests

Seashore's book (202) remains the outstanding general work in the field of music testing. Rupp (186) discusses the technique of measuring eight musical capacities, and indicates the general significance of results along these lines. Kwalwasser (109) reviews most of the American music tests now available. Ogden (152) discusses the general conditions and principles of music testing, argues for the recognition in tests of interval sense and of the factors of volume and pitch-brightness, and says of the Iowa work that simplifications will result "as soon as we are able more directly to test the presence and the functioning of those fundamental configurations of apprehension and response without which a musical talent cannot manifest itself." Turning to the Seashore tests, the literature roughly falls into two divisions. First we have studies foundational in the construction of the tests. Anderson (5), Hancock (72), Seashore (201), Smith (209), and Stewart (223) investigate the conditions for measuring pitch discrimination, while Gilliland and Jensen (60) compare the reliabilities of the phonographic method and that of using tuning forks. Malmberg (124) elaborately investigates the perception of consonance, and builds a test adopted by Seashore with some modifications in the matter of criteria (197, 202). Gaw (58) suggests a revision of Malmberg's material, omitting the criterion of purity and making a much easier test. Next we have a number of studies involving in various ways the application and use of the tests, and so involving questions of reliability and validity. Seashore and Mount (205) bring together a mass of data along the line of test intercorrelations, and offer interpretations

of the results reported. Stanton (212, 213) shows that retention and success in a music school is to some extent predictable on the basis of Seashore test scores. Gaw (59) uses the Seashore tests, among others, for a survey of talent in a music school. Larson (116) shows that school music organizations tend to select Seashore test ability. Schoen (193) investigates the relationship of a number of tests, including those of Seashore, to detailed elements in musical performance and ability. Brennan (20) studies the relationship of test scores to ratings on piano performances made by two groups of judges. Gray and Bingham (66) compare the performance of white and colored pupils on the first five Seashore tests, and relate the results to a measure of brightness. Klauer (92) studies the effect of training on scores in the rhythm test. Lenoire (117) compares white and negro children in the tests. McGinnis (123) modifies some of the tests for kindergarten children. Fracker and Howard (55) report correlations between Seashore test scores and measures of intelligence among university students. Brown (22) reports negatively on the validity and reliability of the battery as applied to school children.

Somewhat more general are the discussions of Heinlein, who adversely criticizes the consonance test (74), the test for tonal memory (75), and the test for pitch discrimination (77). His critique of the consonance test is discussed experimentally by Larson (115), Heinlein (76) offering a rebuttal, and in a more general way by Seashore (198). Farnsworth (48, 51) and Lanier (113, 114) discuss the applicability of the Spearman-Brown prophecy fomula to the Seashore tests.

Turning now to other music tests, we find Révécz (164) proposing eight measures of musical capacities, based on his study of the prodigy Nyiregeházi, and insisting that musicality is unitary rather than atomic. Schoen (190) devises and discusses tests of relative pitch, tonal sequence, and rhythm. Wright (258) discusses the relationship of her tests to those of Seashore. Kwalwasser (109) makes an extended general critique of the Seashore tests, and describes the test devised by himself and Ruch. Mosher (144) correlates seven measures of various musical capacities with sight singing and finds that the ability to write melodic themes has the highest prognostic value. Gaw (57) proposes a sight singing test. Brennan (19) analyzes tests of ability to sing a tone, to sing an interval and of voluntary pitch control. Lowery (119, 120) describes

very interesting tests for cadence, phrase, and recognition memory of musical themes appearing in variations. Andrews (6) summarizes a number of the earlier methods of measuring auditory capacities, some of which are of interest to musicians. We have two tests of motor rhythm, one by Travis (237), who used free tapping of a series of rhythms culled from Bach, and another, requiring elaborate instrumentation, by R. Seashore (206), who presents intercorrelations between his test and the Seashore battery, and finds kinaesthetic memory an essential factor. Nielsen (149) makes an experimental study of this last test, using 40 subjects.

Psychology of the Musician

The general psychology of the musician is studied by the Pannenborgs (155), who examined 3,860 children, 423 musicians, and the biographies of 21 composers. Miller (139) made a study of the school achievement of 826 students from eighteen to twenty-one years old, to ascertain the relation of musical ability to other capacities, and confirms all other studies in finding that musical talent is ordinarily accompanied by good all-around ability. Haecker and Ziehen (69, 70), Koch and Mjoen (95), and Mjoen (140) present results from elaborate and closely related questionnaire studies bearing on the cognate questions of the relationship of musical talent to other abilities, and the inheritance of musicality. The work of Feis (53), who assembles in all 285 cases showing musical inheritance, including those of 28 musical families, also bears on these two problems. Stanton (214) in this country makes an extensive study of families of musicians, using the first five Seashore tests as well as questionnaires. Copp (29) advances the claim, though perhaps on rather meager grounds, that every child has musical ability. Révész (166) argues that musical talent inevitably makes an early appearance, a claim which finds emphatic support in the facts assembled by Feis (53).

Stern (216) summarizes and comments on observations of child musicality and tries to classify the natural stages of musical development. Belaiew-Exemplarsky (10) seeks to single out those elements in the musical complex which specially appeal to the young child. Hollingworth (79) uses the Seashore tests to investigate the musical sensitivity of children testing above 135 I.Q. Jancke (86) in a section of his paper, deals with child musicality. Schüssler (194) makes a study of the unmusical child, his criterion being grade and

promotion in school singing. Bernfeld (15) explains the psychology of the unmusical in terms of a " will to be musical."

The psychology of musical composition is dealt with, always in somewhat general terms, by Cowell (31), Jancke (85), and Sabanèev (187). Feis (53) describes the processes of great composers in the act of composition, emphasizing the importance of unconscious factors. Agnew's work (3, 4) shows the great importance of musical imagery in musical creation.

Miscellaneous

Ruckmick (178, 179, 180, 181) contributes a series of important bibliographical summaries dealing in part with music psychology. Howes (81) considers gregariousness in connection with music, the psychology of audience and performer, and applause, among other topics. Feldkeller (54) insists on the importance of the intellectual element in musical enjoyment as contrasted with Einfühlung, though avoiding the extreme of intellectualistic aesthetics. References to comparative music, and musical evolution are frequently found in the studies we have listed, but we may here specially mention in this connection the papers of Bingham (16), Gilman (63), Hornbostel (80), Moore (141), Stumpf (227), and Stumpf and Hornbostel (235). Kryzhanowsky (106) presents an interesting parallel between the evolution of music and general biological evolution.

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FINANCIAL REPORTS OF PUBLICATION ENTERPRISES OF THE AMERICAN PSYCHOLOGICAL ASSOCIATION

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PSYCHOLOGICAL ABSTRACTS

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PSYCHOLOGICAL ABSTRACTS

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Business Office expense	100.00	
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Balance, December 31, 1931		180.18
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BOOKS RECEIVED

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LANGE-EICHBAUM, W., *The Problem of Genius* (Translated by Eden and Cedar Paul). New York: The Macmillan Company, 1932. Pp. xix+187.

TAYLOR, HENRY OSBORN, *Fact: The Romance of Mind.* New York: The Macmillan Company, 1932. Pp. ix+166.

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MURCHISON, CARL (Ed.), *A History of Psychology in Autobiography.* Vol. II. Massachusetts: Clark University Press, 1932. Pp. xvii+407.

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COMBES, MARGUERITE, *Le Rêve et La Personnalité.* Paris: Boivin & Cie, Editeurs, 1932. Pp. xii+264.

HISSONG, CLYDE, *The Activity Movement.* Maryland: Warwick and York, Inc., 1932. Pp. ix+122.

BOOK REVIEWS

PETERMAN, BRUNO. *Die Wertheimer-Koffka-Köhlersche Gestalttheorie und das Gestaltproblem.* Leipzig: Johann A. Barth, 1930. Pp. viii+292.

Peterman gives a thoroughgoing account of the origin, development and present status of the Gestalt theory. The criticism of the psychological school leads the author to the conclusion that at least Köhler has been, and is, of the opinion that the concept of Gestalt is a physical one; but Peterman suggests that the Gestalt theorists actually use the concept of Gestalt as a metaphysical entity, *i.e.*, as something coming "from outside" and arranging bare data in such a way as to create psychological Gestalten. The possibility that Gestaltung is neither a physical nor a metaphysical process, but is a

purely psychological reality, has, according to Peterman, been neglected by the Gestalt school. The proof of this statement is made in a very convincing way.

This book is strongly recommended to adversaries and supporters of the Gestalt theory as an outstanding critique of it.

E. VON DOMARUS.

Yale University.

ZIEHEN, TH., PROF. *Die Grundlagen der Charakterologie.* Langensalza: Hermann Beyer & Söhne (Beyer & Mann), 1930. Pp. 1+372.

This characterology is written from a purely empirical viewpoint, and perhaps nothing can show clearer the limits and failures of an empirical approach to characterology than this book by a man who has at his disposal all the knowledge which contemporary empirics can offer. When we compare Ziehen's Characterology with the endeavor of Dilthey, Jaspers, and the articles in the *Jahrbuch für Charakterologie* we all shall become aware of how little empiricism has to offer for theoretical and practical characterology.

E. VON DOMARUS.

Yale University.

LANGE-EICHBAUM, WILHELM, DR. *Das Genie-Problem Eine Einführung.* München: Verlag von Ernst Reinhardt, 1931. Pp. 5+127.

In our machine age we are likely to mechanize as much as possible; more and more we are taken up by routine work. One has even tried to measure intellect and to see the essence of men of genius in their I.Q.'s. The more this is done, the more we must admire people who turn away from such a superficial approach to scientific problems. Lange-Eichbaum combines the knowledge of a psychiatrist, psychologist, biologist, and sociologist, and has used his detailed knowledge of these fields to work on the problem of genius.

Lange-Eichbaum is known from his main book, *Genie-Irrsinn und Ruhm,* in which he made, on the basis of a study of 800 biographies, the most valuable contemporary account of the problem of genius. The book we have to speak of here is an introduction to this main book.

Only a few points of the results of Lange-Eichbaum's investigations can be mentioned here. We have, first of all, to comprehend

that men of genius are not at all those ideal beings which the majority of people would expect them to be, but they are often men of faults which would make people despise their heroes if their real nature were known. Although some men of common sense have already known that many men of genius are sexo- or psychopaths, furthermore that their glory depends largely on their benevolent environment, the scientific proof of this statement is of utmost importance. It must be said that Lange-Eichbaum has succeeded in proving these and other surprising results of his studies. Anyone who wishes to be taken seriously in a discussion about the problem of men of genius must read the works of Lange-Eichbaum.

E. VON DOMARUS.

Yale University.

NOTES AND NEWS

Announcement of Trips to German and Austrian Psychological Institutes at the Conclusion of the International Congress of Psychology in Copenhagen, August 22–27, 1932:

By agreement with the German and Austrian members of the *Vorstand* of the International Society of Psychology, the *Vorstand* of the German *Gesellschaft für Psychologie* will arrange for foreign members to visit the larger German and Austrian psychological institutes after the Congress. The organization of the round trips is in the hands of Professor D. Katz, University of Rostock. At the earliest possible date Professor Katz will get in contact with the proper persons to carry out the suggestions of members who are interested. Additional announcements concerning these trips will be made later. For further information write to Professor D. Katz, University of Rostock, Germany.

A later communication from Professor Katz:

The following is an advance program, the final form of which will be presented during the Congress in Copenhagen:

Leave Copenhagen for Rostock (Germany) on August the 28th, arriving at Rostock on the same day. Inspection of the Rostock Institute on the 29th, leaving for Hamburg during the afternoon, and arriving there in the evening (of the 29th). Remain in Hamburg on the 30th and 31st, visiting the Hamburg Institute on the 30th. Journey to Berlin on the 31st, arriving on the evening of the same day. Remain in Berlin on the 1st, 2nd, 3rd and 4th of September, inspecting the Berlin Psychological Institute on the 1st, the

Institute for Industrial Psychotechnics on the 2nd, leave for Leipzig on the 4th. Visit the Leipzig Institute on September the 5th. On September the 6th, travel from Leipzig to Halle, Jena and Weimar, visiting the Institutes of Halle and Jena on September the 9th.

Two groups (Group I and Group II) will be formed to continue the trip from Leipzig.

Group I leaves Weimar, or Leipzig, for Dresden, on September the 7th, arriving at Dresden on the evening of the 7th. Remain in Dresden on the 8th and 9th. Travel from Dresden to Vienna on September the 9th, visiting the Vienna Institute on the 10th. Vienna marks the end of the trip. It is advised to return from this point through Innsbruck and Munich.

Group II leaves Weimar, or Leipzig, on September the 7th for Göttingen, visiting the Göttingen Institute during the forenoon of September 8th, leaving on the afternoon for Marburg, arriving in the evening of the same day. Inspection of the Marburg Institute on September the 9th, leaving for Frankfurt on the afternoon of the 9th, arriving in the evening of the same day. Inspection of the Frankfurt Institute on September the 10th. On the 11th and 12th travel from Frankfurt to Giessen, or Mannheim, or Heidelberg. Inspection of the Institute of Giessen or Mannheim on the 11th of September. Travel from Frankfurt or Mannheim or Heidelberg to Würzburg on September the 12th. Inspection of the Würzburg Institute on September the 13th. Trip to Munich on the 13th or 14th of September. Visit the Munich Institute on September the 14th. The trip of Group II ends at Munich.

I very much desire early information regarding those who plan to take part in the trip. During the Congress in Copenhagen a place will be provided which can give detailed information.

PROF. DR. D. KATZ, Rostock (Meckl.), Moltkestr. 13.

DR. CHRISTIAN A. RUCKMICK, Professor of Psychology at the University of Iowa, has this year completed a state-wide lecture tour under the auspices of the Graduate College. This college annually selects a member of its staff on the grounds of his distinction as an investigator. Some twelve universities and colleges are visited. The subject of the address this year was "An Experimental Approach to the Study of the Emotions."

PROFESSOR MAX VON FREY of the University of Würzburg died on January 25, 1932, at the age of eighty years.

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